Integrated Pilot Plant to Convert Corn Stover to Fuel and Chemicals

Archer Daniels Midland will develop a pilot plant to demonstrate the continuous production of cellulosic ethanol and butyl acrylate from densified corn stover.

A major challenge of utilizing biomass for conversion to fuel and chemicals is the low density of biomass and consequently high transportation costs. Archer Daniels Midland (ADM) developed a process to pretreat and pelletize corn stover—increasing its density by a factor of three. A higher density allows use of ADM's existing agricultural transportation infrastructure for long-term storage and reduced transportation costs. Economies of scale are realized by transport of densified biomass to one central processing facility, which permits an economically viable conversion to fuel and chemicals.

An integrated pilot facility processing one dry ton per day will provide the necessary data for the future scale-up to a centralized commercial plant. More information can be found on the ADM website.

Project Description

A number of small conversion plants located within a 50-mile radius of corn growers convert low-density stover into dense pellets. After transport to a centrally located integrated plant, the densified corn stover is separated into its three major components: cellulose, hemicellulose, and lignin.

Hydrolysis converts cellulose and hemicellulose fractions into sugars, while lignin is utilized as an energy source for process steam generation. Some of the sugars are fermented to ethanol, and the remaining sugars are hydrogenated to polyols. Catalytic conversion of the polyols, followed by processing of resulting intermediates, yields the butyl acrylate chemical. This value-added compound is used to make plastics, adhesives, paints, coatings, and a range of other materials.

ADM's Agricultural Processing and Biofuels Production Facility in Decatur, Illinois.

Potential Impacts

The process is compatible with an existing distributed biomass system and minimizes biomass transportation costs. The pilot facility will demonstrate an integrated fuel and chemicals operation with a greater market value than biofuels production alone. Compared to production from petroleum, butyl acrylate derived from biomass is expected to be more economical due to lower capital investment and catalyst expenses, while reducing the carbon dioxide footprint.

Other Participants

ADM has licensed technology from Battelle Memorial Institute as operator of Pacific Northwest National Laboratory on advanced catalysts to convert polyols to the chemical intermediates of butyl acrylate.

Prime	Archer Daniels Midland
Location	Decatur, Illinois
Feedstock (s)	Corn Stover
Size	1 dry ton per day
Primary Products	Ethanol Fuel, Butyl Acrylate, and Process Heat
Capacity	25,800 gallons of ethanol and 21,000 pounds of butyl acrylate per year
Award Date	January 2010
GHG Reduction	61% over petroleum-derived fuels
Anticipated Job Creation	55 construction jobs and 14 sustained
Company Contact	Thomas Binder, binder@adm.com, 217-451-4228

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